

Grazing-incidence small-angle x-ray scattering from Ge islands on Si(100)

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Introduction

Self-assembled quantum dots of Ge grown on Si(001) have been attracting a lot of attention. Many groups have studied this system to understand its kinetics and thermodynamics [1]. Important characteristics of the system are the island sizes and the distances between them. Grazing-incidence small-angle x-ray scattering (GISAX) has already been developed to study thin film growth [2]. We attempted to use this technique in an *in situ* growth situation.

Methods and Materials

One obstacle to using small-angle scattering in an *in situ* growth experiment is scattering from Be windows. A multi-bounce channel-cut crystal was used to remove scattering from windows and various other sources. The experiment was done using the ultrahigh vacuum diffractometer at the UNI-CAT surface/interface experimental station. Ge was grown from an electron beam-heated Mo cup (Omicron) with the deposition rate at 0.24 Å/min. Six milliliters of Ge film was grown at the sample temperature 330°C; x-rays at 8.965 keV were used. The GISAX data were obtained at the incoming and outgoing angle at 0.13°.

Results and Discussion

GISAX data were obtained first with the Ge film. The film was flashed out by briefly heating to 1250°C. Another GISAX was taken with the resulting Si(100) substrate (Figure 1).

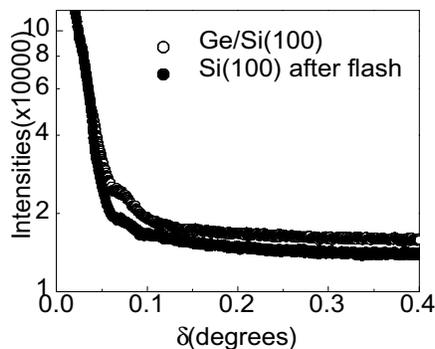


Figure 1: GISAX data obtained from Ge film and resultant Si(100) substrate.

Figure 2 shows the difference between the two data sets. One can clearly see the peak at 0.06°, which corresponds to the island distance 1300 Å. We plan to use this technique to study the kinetics of Ge island growth on Si(100).

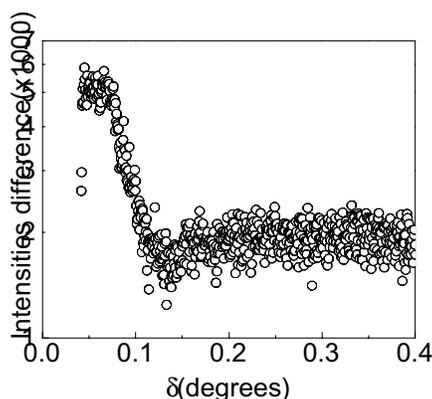


Figure 2: Difference between the GISAX data sets of the Ge film and the Si(100) substrate.

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References

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